

CAPT. FAVER Instructor

5-1-45

I Aircraft Control

II Radio Aids to Navigation

III Weather

AIDS TO STUDY

1. Course Outlines
2. Technical Library - located in Ground School
3. Tests Basic (10 days) 5 dailies (10 min) } averaged for final grade
1 comprehensive (1 hr)
4. Instructors conferences - Evenings following quizzes

GROUND RULES

1. Report to class on time.
2. Regulation Uniform
3. No cokes in classrooms

GROUND SCHOOL SCHEDULES.

Sydn #	Time Subject Instructor Place
	Coded on left of schedule

Sick Call

8:00 weekdays
13:00

9:00 Sunday

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Section I

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SENSATIONS IN INSTRUMENT FLIGHT - Capt. Bernstein - flight surgeon

NORMAL SENSATIONS

A. Not usable in flying

1. Touch
2. Taste & Smell
3. Hearing
4. Temperature

B. Useable sensations in flying

1. Vision
2. Deep Muscular Sense
3. Sense of equilibrium

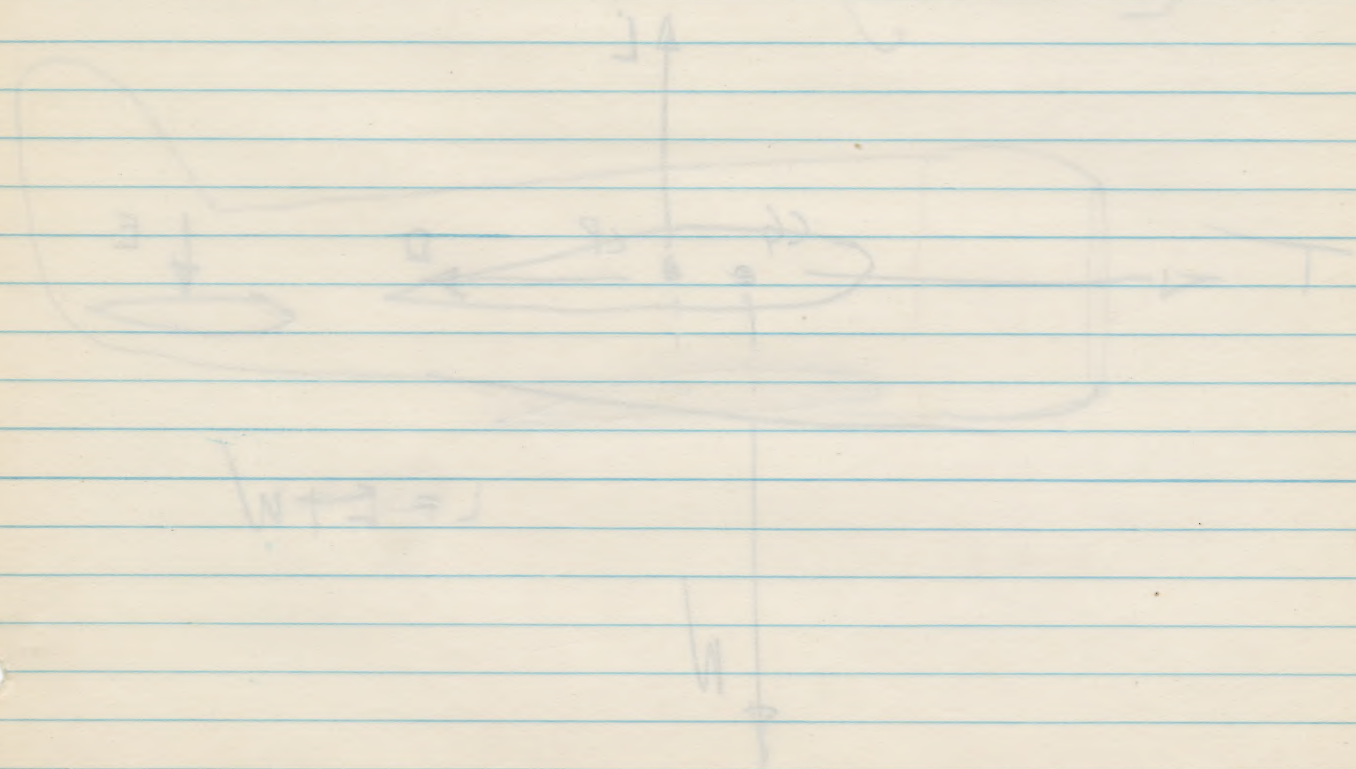
} Contact flying
Instrument flying

Deep Muscular Sense

Going into and out of banks gives misleading impression of climbing and diving.

Sense of equilibrium

1. Inner Ear (Semi Circular Canals)
a. Misleading impressions
1. Leans



AERODYNAMICS

ATTITUDE ^(PITCH) - Relationship between wing ^{axis} & long. axis of plane and the horizon.

RELATIVE WIND - Reciprocal of flight path.

ANGLE OF ATTACK - Angle between chord of wing and relative wind α

FORCE - Has both magnitude & direction

FORCES - Weight - constant in direction & magnitude

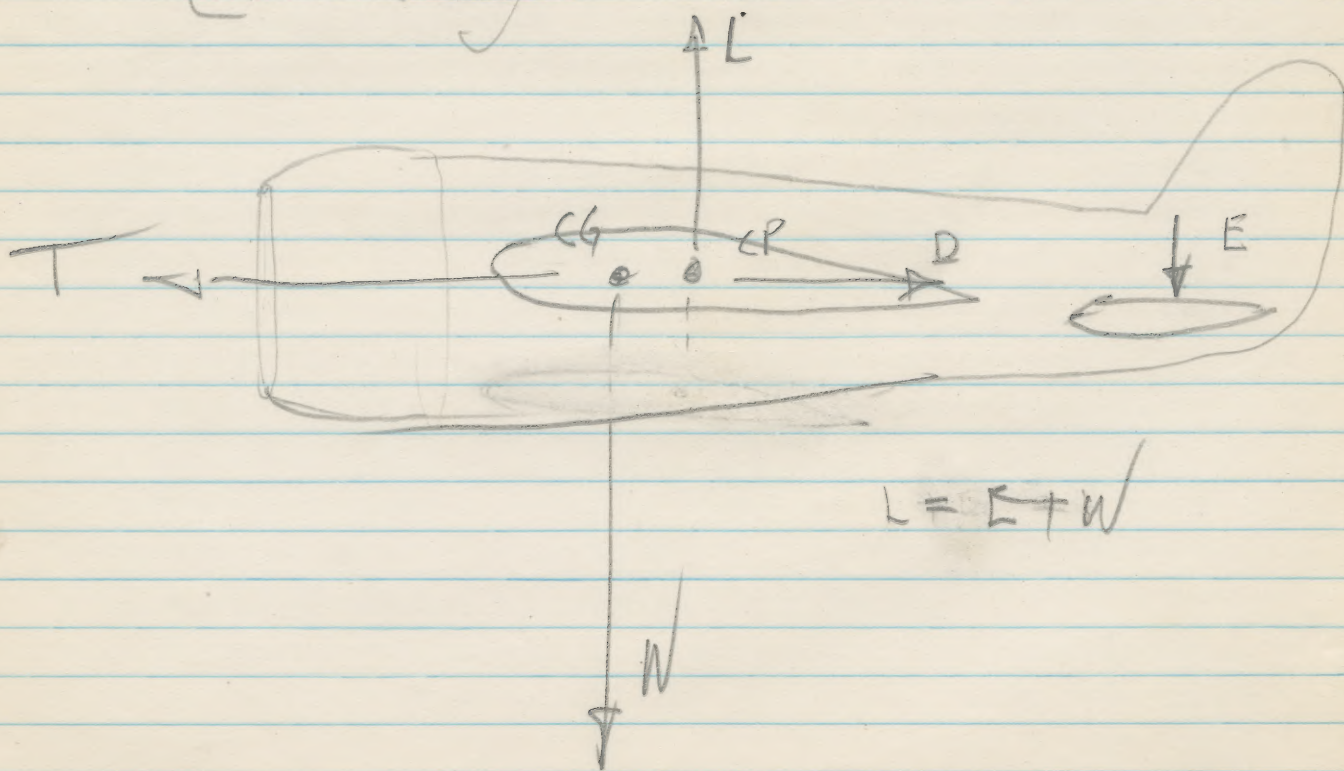
Thrust - controllable in direction & magnitude
acts along longitudinal axis

Lift - controllable - acts \perp to flight path

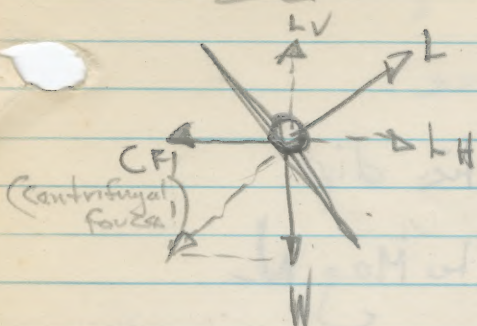
Drag - uncontrollable - acts \parallel to flight path

DRAG

{ Parasite Drag - uncontrollable - acts \parallel to relative wind
Profile Drag -



BANKS



Centrifugal Force

Altitude Constant

$$CF = \frac{M_{av} V^2}{\text{Radius}}$$

Air Speed	Rate of Turn	Z of Bank
constant	Increase	Increase
"	decrease	decrease
Increase	constant	Increase
decrease	"	decrease
Increase	decrease	constant
decrease	Increase	"

MAGNETIC COMPASS - only truly reliable compass

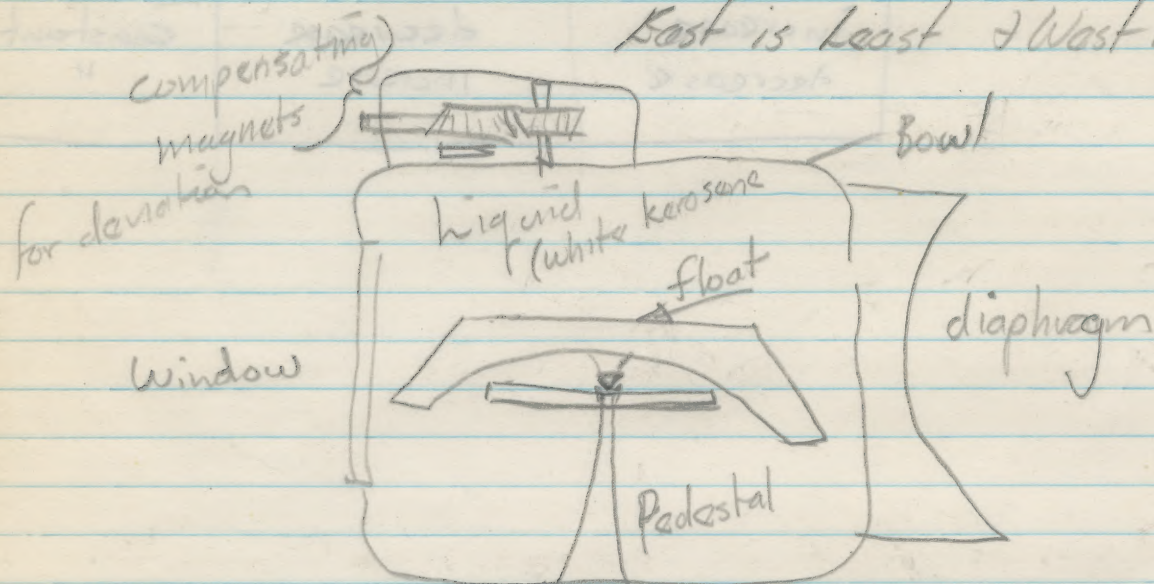
Magnetism - Bar magnet - lines of force

Earth's lines of force - cause magnetic dip

Variation - difference from True N. to Mag. N.

Working from True Course to Mag. Course

East is Least & West is Best

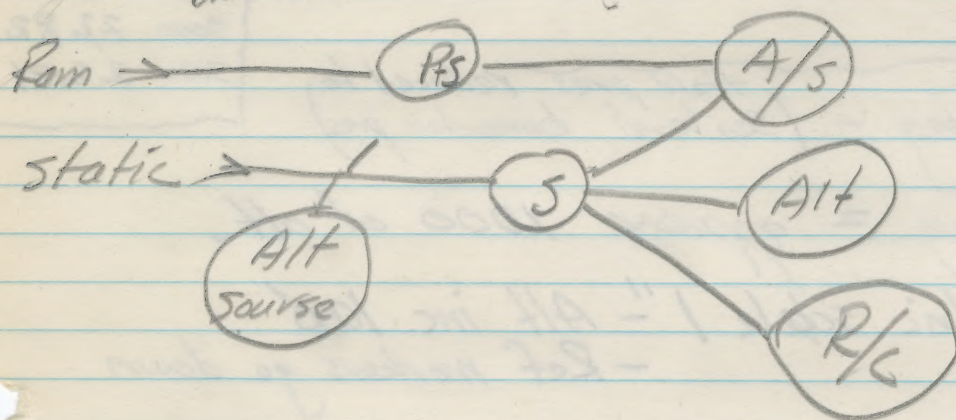
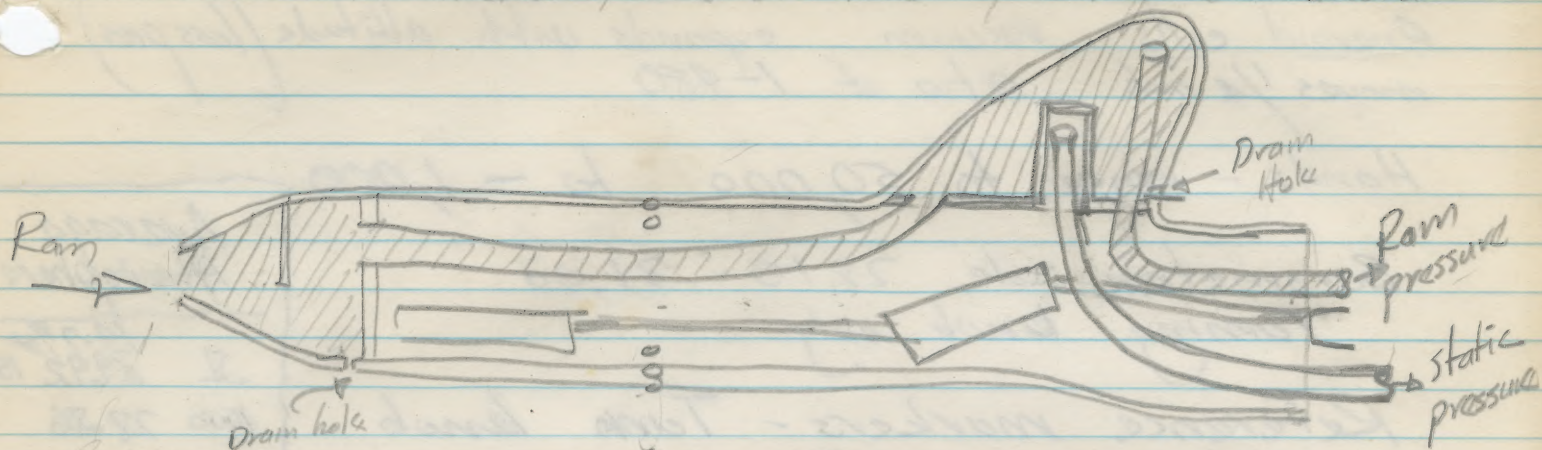


Acceleration Error - E & W headings max error
N & S " no error
caused by

Northerly Turning error Max @ N & S & at
north latitudes
in bank N pole of magnets which is at 5
indication of said indication magnetic dip.

PETOT STATIC SYSTEM

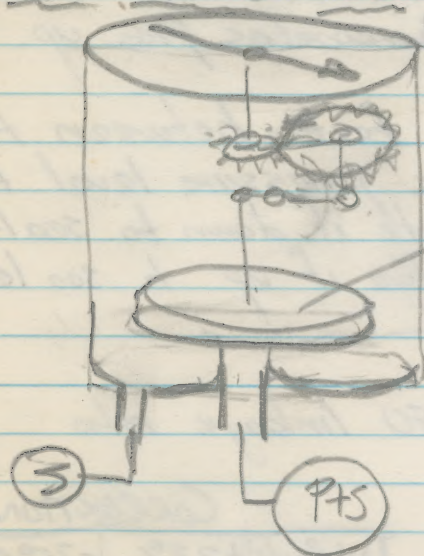
Altimeter, rate of climb & Airspeed indicator



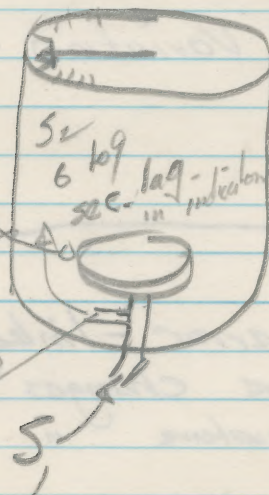
Mounted to be // to Relative wind at cruise.

AIR SPEED IND

Rate of Climb



Diaphragm



Compensated for pressure
& temp changes

10000
9000 — -83"

5000
5000 — -75

1000
0 — 1.06
29.92

ALTIMETER -

Aneroid cells vacuum expands with altitude (loss pres)
moves $\frac{1}{4}$ inch ratio of 1-480

Hands - range to 50,000 to - 1,000

Barometric scale 28.10 - 31.00

Turning knob only

Reference markers - Turn knob

Average
Atmosphere

SL 14.74 in
29.92 15°

1000 28.86

2000 27.82

3000 26.81

Altimeter setting - (field pres. reduced to,
Sea level barometric pres.)

1 inch mercury = approx 1000' of alt.

change barometric scale 1" - Alt inc. 1000'
- Ref markers go down

Hands set to known elevation - barometer reads
sea level pressure

REFERENCE MARKERS - Pressure Alt. Variation

Movement - 100' down to -10" Barometric pres. up.

Pressure Alt. Variation - difference in feet between the
29.92 barometric pressure level to
sea level. (Negate if down to sea level
Positive if up to sea level)

ERRORS

1. Inst. error - linkage due to 1-480 linkage ratio
2. Pressure changes in atmosphere
3. Temperature " " "

INST ERROR - Scale Correction Card

Alt Reads	CORRECTION	
	+23°C	-25°C
0	0	-5
250	+5	-2½
500	+10	0
1000	0	-15

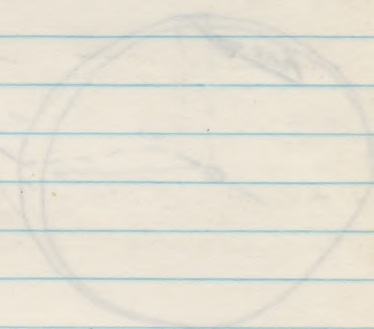
PRESSURE CHANGES - Flying into an area of lower pres.
you are lower than act alt.

TEMPERATURE CHANGES - Flying into an area of lower
temp you are lower than act alt.

E6B Computer - Ind Alt. \pm Error = Cal. Alt.

True Alt
on E6B
computer { Pres. Alt. = Height in standard air 29.92 = Sea Level pres.
Set altimeter to 29.92 to get pres Alt.
Air Temp =
Cal. Alt. =

Altitude	Pressure	Temp
0-1000	29.92	15.0
1000-2000	29.54	11.3
2000-3000	29.16	7.6
3000-4000	28.78	3.9
4000-5000	28.40	0.2
5000-6000	28.02	-3.5
6000-7000	27.64	-7.2
7000-8000	27.26	-10.9
8000-9000	26.88	-14.6
9000-10000	26.50	-18.3



GYROSCOPES

DESIGN CHARACTERISTICS

1. Great weight for size.
2. Rotate at high speed.

MOUNTING OF GYRO

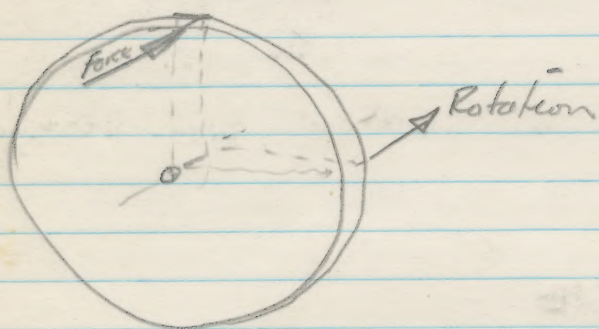
1. Universal (Free)
2. Rigid or Semi rigid

INST.	PRINCIPLE	MOUNTING
D/G	Rigidity	Universal
F/I	"	"
T/B	Precession	Semi Rigid

Deflection of a moving body is directly proportional to the deflective force applied and inversely proportional to the weight and speed of the body.

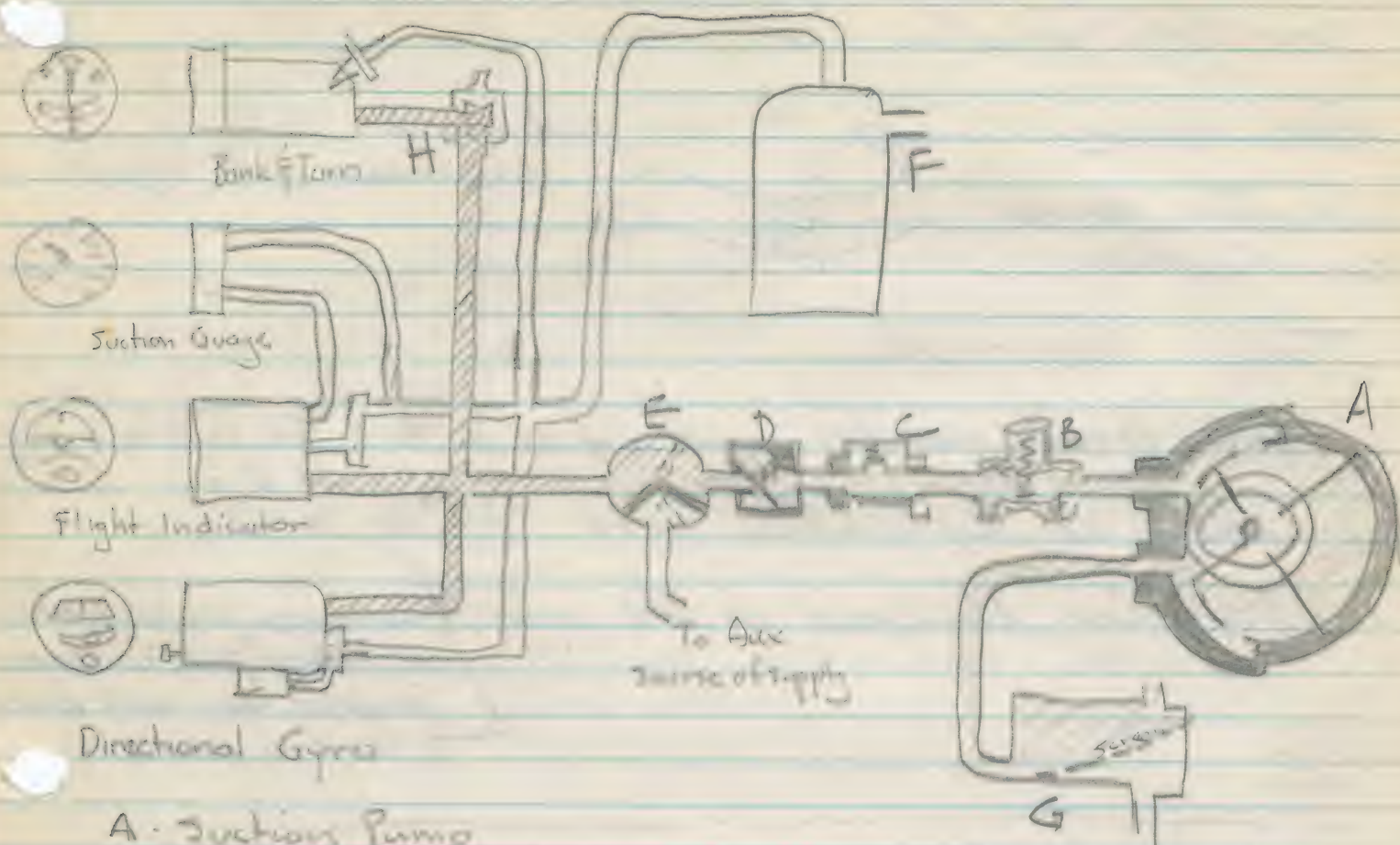
PROPERTIES

1. RIGIDITY -
2. PRECESSION - A force applied to a rotating gyro results in movement of the gyro (precession) as tho the force were applied to the gyro 90° in the direction of rotation



SUCTION		
INST.	LIMITS	DESIRED
D/G	3.5"-5.0"	4.0" Hg.
F/I	3.5"-5.0"	4.0" Hg.
T/B	1.8"-2.1"	1.9" Hg.

SUCTION SYSTEM



A. Suction Pump

sliding vane type, 10" vacuum at cruising settings
engine driven

B. Suction Relief valve

Regulates suction to 4"

C. Pressure Relief Valve

In case of Back fire

D. Gate Check Valve

In case of back fire

E. Selector Cock

F. Master Air Filter

G. Air Oil Separator

H. T&B Restrictor Valve

TURN & BANK MONITOR

Sim Rigid mounting - car pressure

~~Car pressure~~

indicator card
coordination



on for cushion to take up
expansion of liquid.

TURN MONITOR

Sim Rigid mounted gyro free to turn in rotation axis
in 1 axis \perp to 2^{nd}

Rotates at $10,000 \pm$ RPM with 1.9" Hg suction

Increasing the speed of the rotor

{ increases pressure line
decreases pressure mount
increases turn rate
(made by pressure line)

DIRECTIONAL GYRO

Suction 3.75" Hg to 4.25 Hg Desired 4" Hg

Rigidity in space - property of gyro used in this inst.

Inst. stopped at bank of 55° to guard against
gimble lock (have gimble lines with virtual gimble)

Spinning caused by loose gimble striking this stop
or limit and precessing gyro.

ERROR

1. Friction - primary cause
2. Gimbals 1^{st} out of balance
3. Rotation of earth ($5-6^\circ$ creep per hour)

Allowable creep 3° for 15 mins.

5 min warm up required to reach speed at 4" Hg.

PSYCHOLOGY OF TEACHING

I. DEALING WITH OTHER PEOPLE - Use common sense.

A. LARGE GROUPS

1. Personal Appearance
2. Unorthodox material
3. Logical arrangement
 - a. Logical progression
 - b. Flowing
4. Effective Presentation
 - a. Good Voice
 - b. Talk loud enough
 - c. Have appeal - something for them
5. Enthusiasm
6. Posture
 - a. Look audience in the face.
 - b. Stand up straight
7. Eliminate distracting elements
 - a. Don't fiddle with keys, paper, pens, etc.
 - b. Don't use any phrase or word repeatedly.
8. Use Visual aids along with oral description
 - a. Use hand nearest the object to point out items
 - b. Make visual Aids
9. Get audience in small compact group close to you
10. Begin with common information
 - a. Common information
 - b. Common agreement
 - c. point of difference

B. SMALL GROUPS

1. Avoid
 - a. Wasting time (lost in preparation)
 - b. Discussing other people in their absence.
 - c. Discussing other items about which we are not familiar (other aircraft etc)
- Base all statements on fact.

C. DEALING WITH THE INDIVIDUAL

1. Know the individual's background, etc.
 - a. Start with man's level of understanding & experience.

INSTRUCTOR EVALUATION

A. PERSONAL TRAITS

1. Discipline
2. Ability to get along with people

B. ACADEMIC TRAITS

1. Knowledge know what you teach
2. Planning
 - a. Analyze what you are teaching
 - b. Make subject fun & attractive
 - c. Arouse interest
 - d. Some perspective
 - e. Emphasize important points & goals.

Remote Indicating Compasses

DISADVANTAGES OF PANEL TYPE MAGNETIC COMPASS

1. Variation
2. Dip Error (also swirl error)
- 3. Deviations
4. Variations in strength of earth's magnetic field.

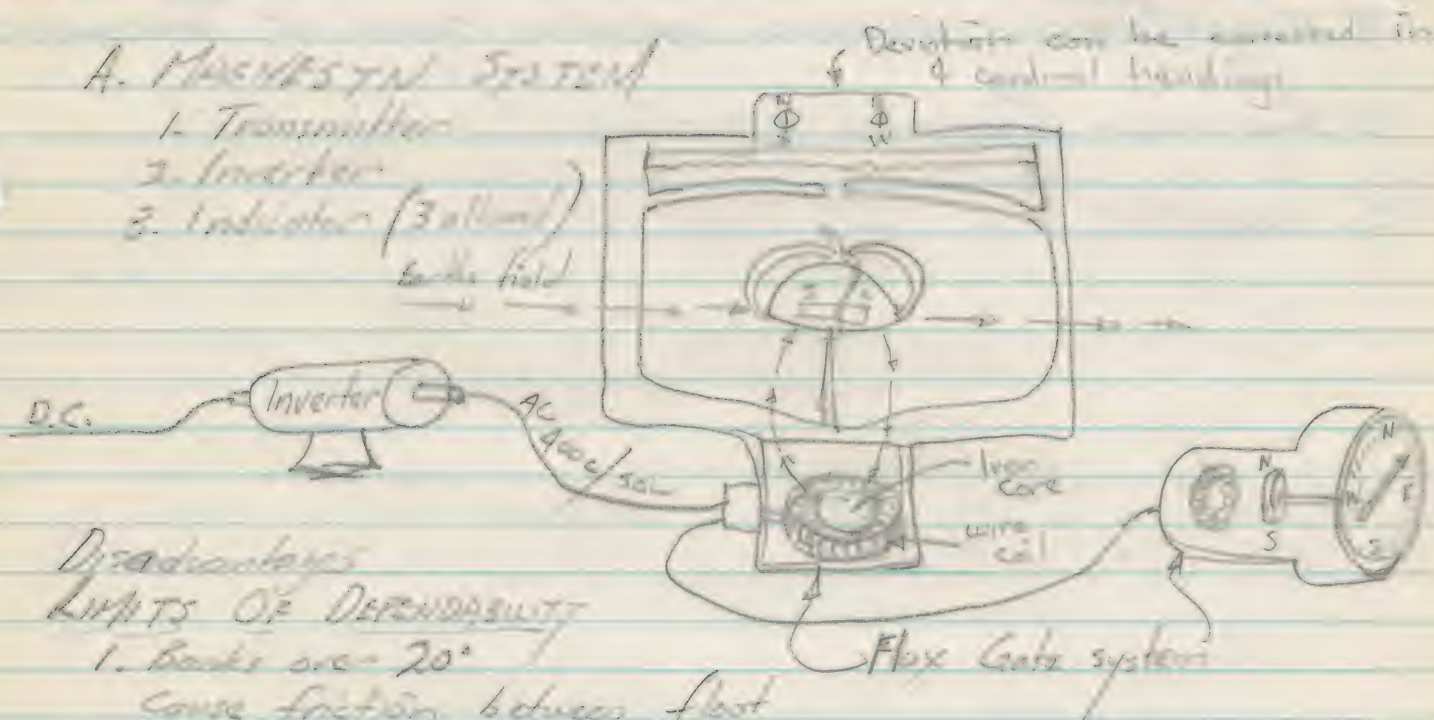
TYPES

A. MAGNESYN Remote Indicating System

B. GYROFLUX GATE COMPASS SYSTEM

A. MAGNESYN SYSTEM

1. Transmitter
2. Inverter
3. Indicator (3 all round)



Disadvantages

LIMITS OF DEPENDABILITY

1. Banks over 20°
cause friction between float and case.
2. Variation
3. Dip & Swirl
4. Deviation cut down to great extent and is constant
5. Variations in strength of earth's magnetic field.

B. GYROSTYL FLUX GATE Compass System

1. Transmitter -

- Gyro Stabilized - eliminates slip error
- 65° pitch & bank allowable
- Has compass device
- Erection device to keep gyro in vertical plane.
10500 rpm in gyro

2. Master indicator

- Compensating mechanism corrects for deviation $\approx 75^\circ$
- Variation setting knob
- Repeater indicators indicate exactly as master indicator. (6 available)

3. Amplifier - increases indication signal of Transmitter

4. Gaging - Electrical operation

5. Inverter.

ATTITUDE OR Full Power Instrument Flying

Method of flying airplanes by instruments as you do when flying contact - obviously wings level, nose on the horizon. Most think in terms of Altitude flying.

I Instrument Concepts

A.1. { Experienced inst pilot 120 eye fixations/min
(Inexperienced - 60)

2. Practice covering all instruments

B. Instrument Arrangement

1. 44 standard inst panels in array

2. Standard panel necessary

II Instrument Interpretation

1. Know how to interpret each inst

2. Inst panel design important

3. Relying too much on one inst, omitting an inst, depending on unreliable inst.

III Aircraft Controls

Transitions problems only.

OLD 1-2-3 (Needle, Ball, Airspeed) Method of Flying Instrument

CONCEPT

1. Inst. Close together GOOD
2. Few instruments GOOD
3. Simple procedures (2-3)

CONTROL

Needle - with rudder
Ball - with ailerons
Airspeed - Flaps
Altitude - Throttle

3rd
inst
method

NEW Full Power

CONCEPT

1. Many instruments 3rd
2. No definite order GOOD

CONTROL

1. Prime instruments for each attitude or maneuver
2. Control like in contact flight
3. Coordination of Controls

INTERPRETATION

In terms of attitude of airplane compared to inst. indications

FLIGHT INDICATOR

LIMITS 110° bank 70° pitch FEARS

ERECTING Mech $5^\circ/\text{min}$

Section Max 4.25 Min 3.75
Desired $4.0^\circ/\text{min}$

1. Acceleration & Deceleration error
2. Skid & Slip error
3. Turn Error (Pitch & Bank mixture)
4. Friction
5. Unbalance

CAGING

1. Leave gyro uncaged at all times except in acrobatics.

E-68

Dist - outer scale
Time - Rotatable Scale

(mi/hr) Rate - always opposite black arrow

<u>Time</u>	<u>Distance</u>	<u>Speed</u>
<u>Time</u>	<u>Quantity Fuel</u>	<u>Gal hr.</u>
3+55	110	28
2+10	185	<u>35</u>
4+00	<u>448</u>	112
4+17	697	<u>111</u>

Ex 1 Pg 5

1. 145 mph
128 mi

$$T = \frac{D}{R} = \frac{128}{145} = 0+53$$

2. 1+17
150 mph

$$mi = 192$$

3. 1+12

4. 142 mph

5. 83.2 mi

6. 157 mph

7. 1+22

8. 149.5 mph

9. 115 mi

10. 144.5 mph

Ex 2 Pg 6

1. 29 gph

2. 4+22

3. 1+42

4. 30 gph

5. 4+14

6. 34.2 gph

7. 71 g

8. 79 g

9. 35.2 gph

10. 95.5 g

Ex 6 Pg 9

1. 184.5 mskm

2.

3.

4.

5.

True Airspeed

Ind Alt

10,000

4.2 TC

-10°C

Ind AS

160

TAS 185

miles off on circle 2nd } 2nd
miles off on circle 1st } 1st
miles off on circle 3rd } 3rd
miles off on circle 4th } 4th
miles off on circle 5th } 5th
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miles off on circle 100th } 100th



miles off course in 60 miles = degrees off course

Pg 7 Pg 10

Ex 3 Pg 7

1. 142
2. 180
3. 228
4. 236
5. 149
6. 132
16. 194
17. 163
18. 196
19. 129
20. 131

1. 8°L
2. 4+2 = 6R
3. 3+1 = 4R
4. 3+1 = 4R

TAS 172
WD 300
WV 20
TC 120°

GS 172
TH 170

TAS 165
WD 30°
WV 25°
TC 150°

TH 143
GS 176

TAS 160
WD N
WV 30
TC 90°

TH 190°
GS 157

- Ex 13 Pg 17
1. E 156
2. 02° 122
3. 156° 121
4. W 130
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

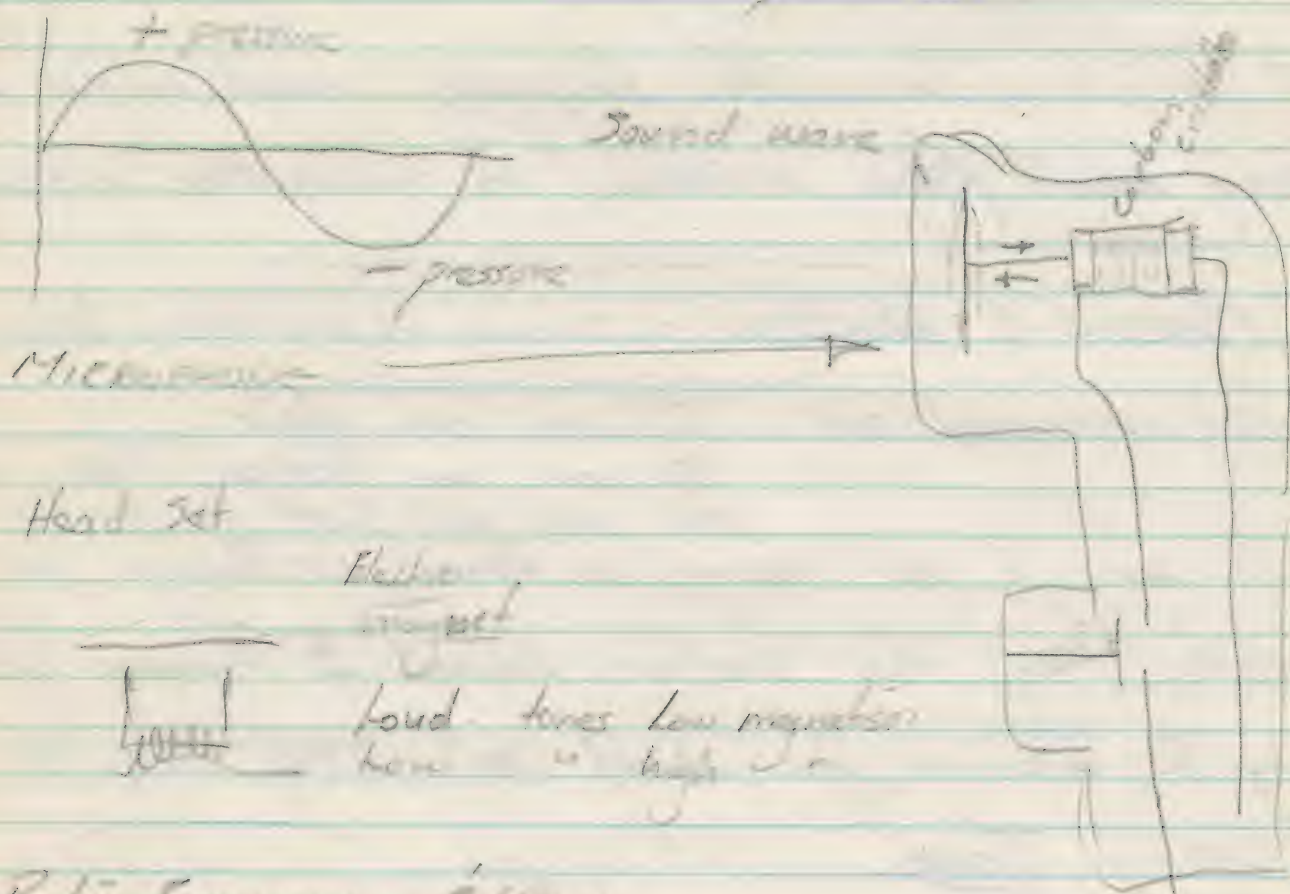
Introduction To Radio

Sound Wave

Frequency - cycles/sec

Human ear receives { 20 - 20,000 Normal
cycles/sec
200 - 12,000

Speed of sound is 1090 ft/sec



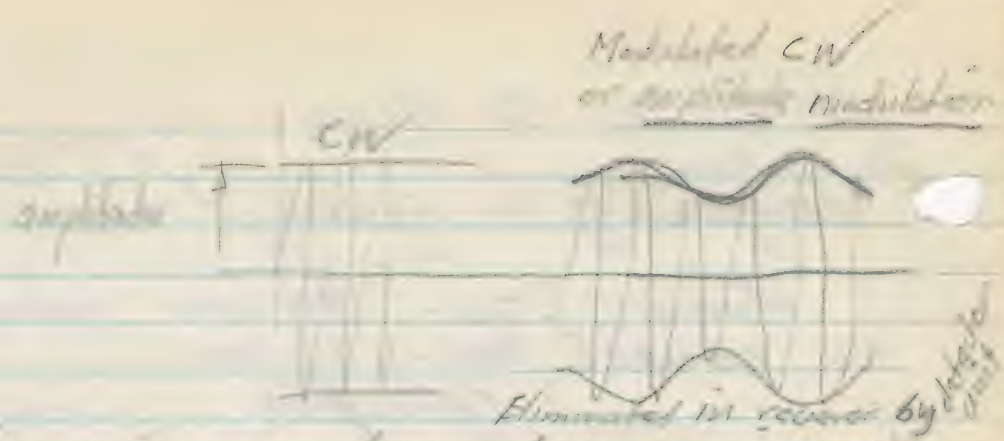
Radio Frequency & Waves

1. Radio Frequency has particular wave length
2. High frequency has short antenna
low " " " long "
3. Travel at 186,000 mi/sec (speed of light)
4. Called electro magnetic & static waves

1,000 cycles = 1 KC kilocycle

1,000 KC = 1 MC megacycle

TRANSMISSION



Modulation - applying voice or tone to a carrier wave

Modulation good transmitter 150-8000 C/sec

To receive a transmitted frequency must receive on same length (same resistance) as transmitter antenna

MARCUS & HORTON - simple to understand radio radio.

Old command set 25 mi on Voice

50 mi on Tone

100 mi on CW (no tone at all)

In case of not raising a tower or Range on

Voice Key the stations signal 3 times followed by K meaning go ahead ie D V Q D V Q D V Q K

using Tone -

R 5 5 5

R - Readability

S - Signal Strength

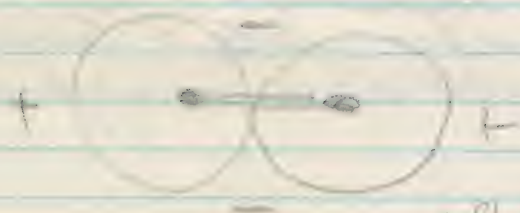
Radio Compass



Aerial Ground Systems

1. Picks up radio wave
 - a. must be in resonance with transmitting antenna
2. Picks up radio wave

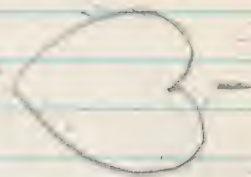
Loop opposite sides of loop are 180° out of phase



Vertical Antenna



Left loop driven to Vert. Ant. +



Radio Compass

Automatic volume control on Compass
No " " " " { Antenna
loop

STATIONS

200 - 410 Range, Towers, Homing
410 - 850 Homing, Commercial
850 - 1750 Commercial, Police

Commercial Stations - High power, few identifications
Location not near fields

Range - Antenna Ranges OK Also No NIGHT EFFECT
loop Ranges not so good

HOMING - OK

CW switch

AUTOMATIC INDICATORS

1. Needle always points to station
2. Simple homing - keep needle always on 0° regardless of D/G Heading
3. TRACKING - On track when DG + Compass show some no of degrees off course in opposite direction.

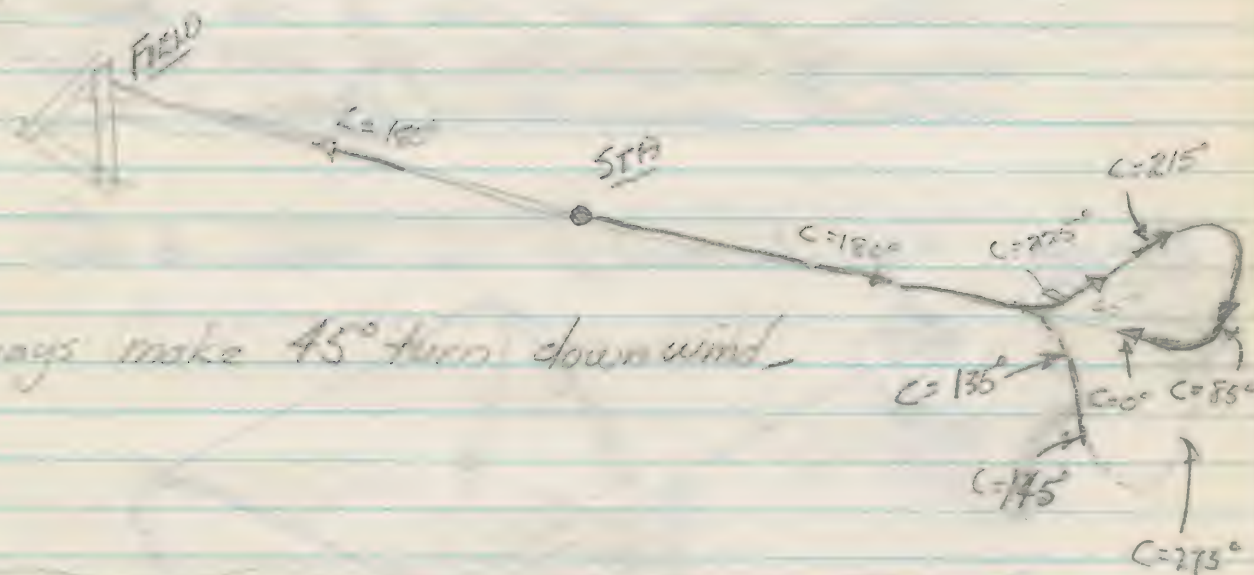
$$T = \frac{60 \times t}{\Delta}$$

T = time from sta. (min)
 t = time thru angular change (min)
 Δ = angle of change

$$D = \frac{TAS \times t}{\Delta}$$

D = Distance to sta. (miles)
 TAS = True air speed (miles/hr)

Automatic Low Approach (four-step)



Always make 45° turns downwind.

AURAL NULL (finder range)

2. Use CW on adecock, bearing sta, + Comical stations.
1. after station has been identified on MSW
3. Increase volume to narrow width of null
4. Best null width 5° to 10°
5. To check direction turn loop to 90° position fly 10° past wingtip null position if compass needle turns clockwise sta. is on right. If needle turns counterclockwise sta. is on left. If turn is 10° mult $t \times 6$ = time from sta.

STA RECOGNITION (Dural Naps)

1. Bank & Fade going to and from sta.
2. Loss null within 60° area then get null again you have just passed sta (without turning volume).
3. When you know you are near sta turn 5° downwind and pick up same tip null.
4. When you get close turn 30° for 30 sec & pick up to sta heading pick up using tip null.
5. When you get close to sta turn loop to wing tip null position fly until you get wing tip null with volume turned down.

BOXING Fly \perp and \parallel to station to field bearing.



5:00
20:00
03:00

8:00
20:00
03:00

RADIO FIXES

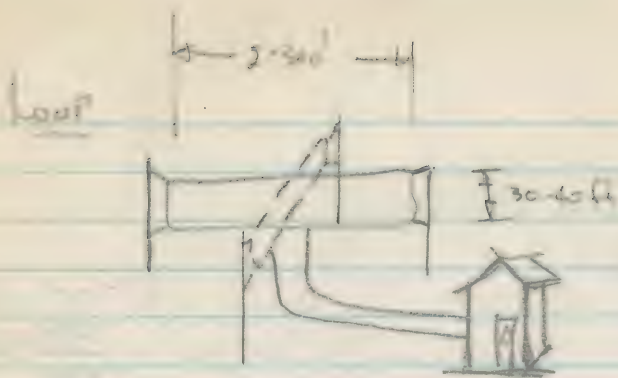
3 Sta fix



2 Sta Fix



Use loop when per capita static is very bad causing needle to swing badly.



Adverse



Uses of Loops Systems

1. Communications -
2. Navigation -

TRANSMIT

200 - 400 Kc common band

200 - 350 Kc 30 many localities
(low power ranges)

V.H.F. band - 5 to 8 Mc

Power Characteristics

High - 150 - 400 watts

Medium - 50 - 150 watts

Low - under 50 watts

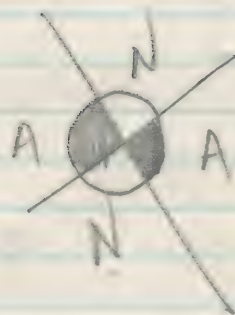
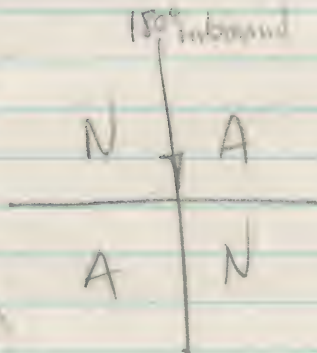
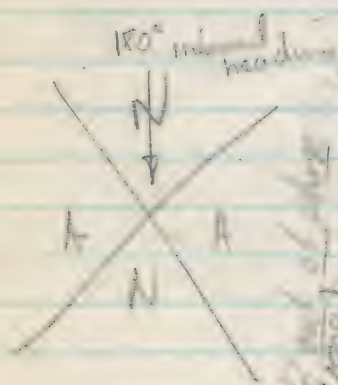
2" or 100 mi. R.L. to RA
1" or 50 mi. MRL, MRA
1/2" or 25 mi. ML

Facility chart

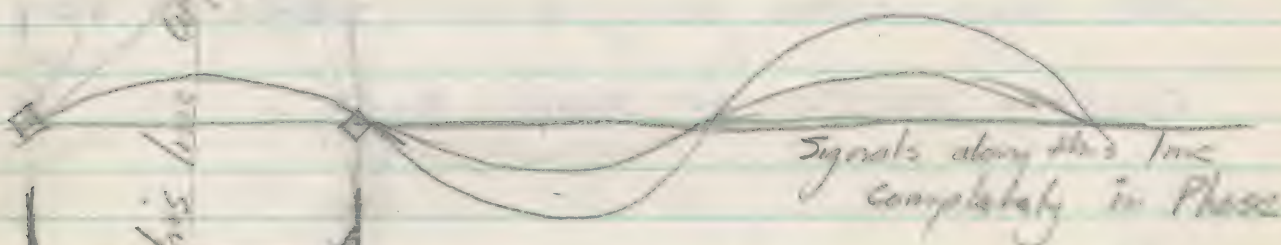
W - Without wire

V - Vane but not simultaneous

S - Simultaneous Vane Range



Facility chart



1/2 wave length center node to add

1020 cycle note



~~Waves~~

Loop - Discontinuity

Adapt correction

1. Sky wave effect at low angles
2. No simultaneous voice & range
3. It's steady corner wave
4. Structure not as rigid

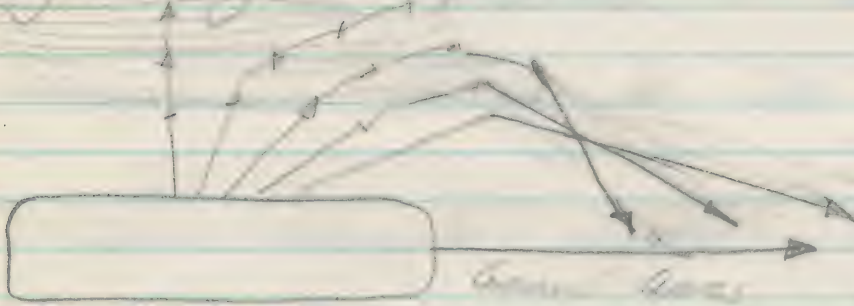
Non mod. carrier wave

Center tower cont. CW
lower

Rigid structure

Sky waves

Heavy Side Layer - Imaginary



these wave effect
ground wave depending
on phasing

Swinging beams - night effect as heavy side layer changes position at sunrise & sunset.

Corner towers	251.02
Center towers	250

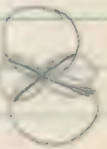
1020 cycles per sec. gross

this tone filtered
out of voice transmission

tone
to guard against
transmission

Moving Beams

1. Change power in one antenna (loop)
2. Use of Phase Adjuster - goniometer (antenna)
3. Set up additional tower to strengthen or weaken beams of other towers



12 EEG LOCITIES IN RANGES

Reflection on mountains

1. Spreading beam or right effect & false fades & builds due to ionized layer striking at dawn and sunset reflecting sky waves - Loop Ranges
2. Split beams caused by power lines reflecting or absorbing ground waves. Permanent,
3. Ore deposits cause bending of beams by interfering primarily with ground waves
4. Echo beams caused by reflection of ground waves from mountain peaks. permanent but do not occur at all altitudes
5. False Cone due to reflection or absorption of ground waves
6. Main defect in range - temporary only

~~the~~ Cockpit Trouble

1. Plane antennas with directional features - more volume ~~in~~ in ~~the~~ certain directions.
2. Banking plane moves beam as received to one side or other
3. Volume Control - Volume level

Static can be destroyed by striking mike button.

Additional Aids

1. Fan & 2 markers
H markers
(200-500 km for hearing
of cone or airplane
desired)

100 watts.

75 megacycle

2 marker

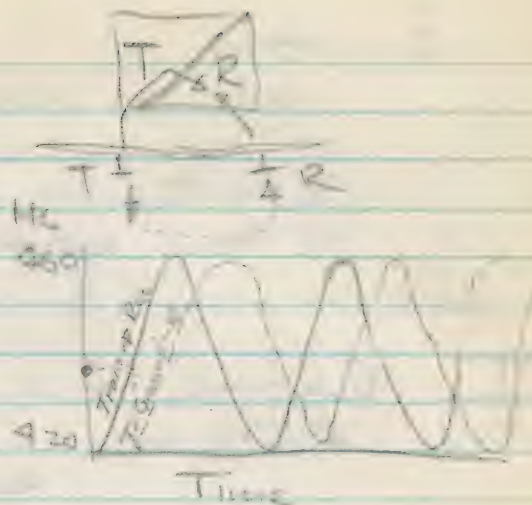


Accuracy Altimeter

I. RADAR ALTIMETER

A. Antenna

1. Transmitting Antenna mounted under one wing.
2. Receiving Antenna under other wing.

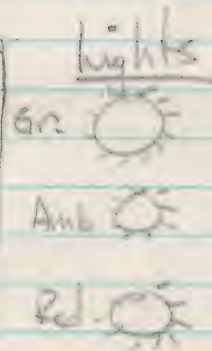


B. Indicators

1. 10 to 500 ft with range knob to change readings to 1000 to 4000 ft.
 - a. Low Range accurate to 3 ft.
 - b. Measure from wheels down position.



2. Altitude Limit Switch



C. ERRORS

1. All installation use same frequency therefore other planes with their set turned on give yours an erroneous reading.
2. Banking up to 60° has very little effect on alt. reading.
3. Indicates ~~vertical~~ vert distance above ground only.
 - A. Dirty antenna will give erroneous readings.
5. Clouds and thunderstorms have no appreciable effect on indications.
6. Requires good maintenance.

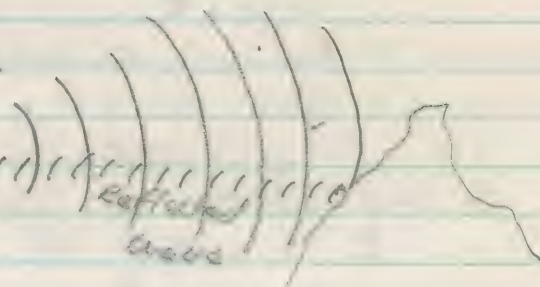
D. USE

1. Auto sub posted used this installation
2. Temp service
3. X-Country flying in weather to clear terrain.
4. Low approaches over known terrain.

II. RADIO ALTIMETER

A. THEORY

400 MC
High voltage
transmitted in pulses



B. Operated by Radio operator

C. accurate to 20 ft as high as 30,000,

BLIND LANDING SYSTEMS

I GIVE PATH LIGHTS

SCS-51

A. FUNCTIONS

1. Expedite Let down
2. Provides : Lateral control and indications
Vertical " "
Horizontal " "

B. REQUIREMENTS

1. Minimum of control manipulation
2. Simple to interpret indications
3. Reliable
4. Straight Glide Path.

C. THEORY

1. VHF 90m signal transmitters.

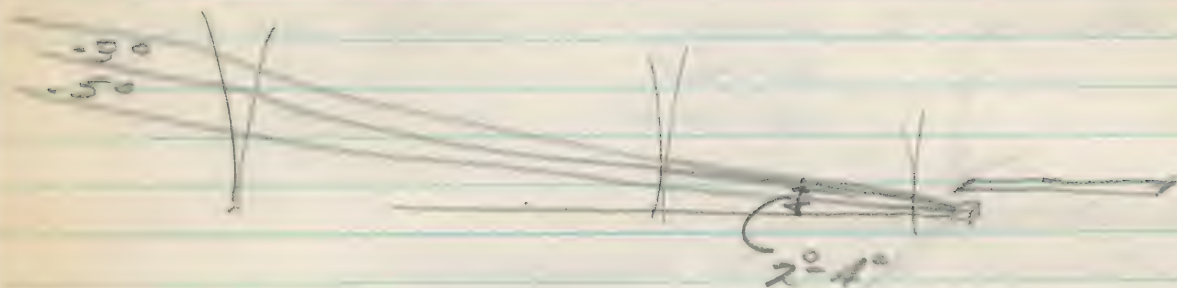
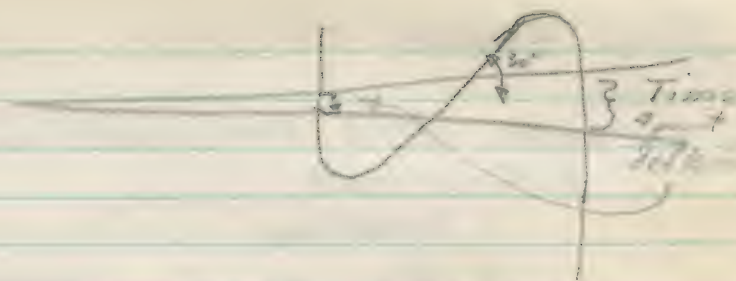
II Ground Controller Approaches

Radio Take over equipment

USE OF AAF INSTRUMENT APPROACH SYSTEM

Loc	Channel	G.P.	ORAL SIGNAL - const. volume			
108.3 MC	U	332.6 MC	YELLOW 90 CPS Squel			
108.7	V	333.8				
109.1	W	335.0				
109.5	X	332.6				
109.9	Y	333.8				
110.3	Z	335.0				
Crystal Loaded			Super Marker 2/sec Light 1200 ft.	Middle Marker 6/sec 200-250 ft	Boundary Marker Steady Light 50 ft	Localiser
			BLUE 150 CPS Squel			

GA102 Path



Navigation Requirements To Be Found in Question

I. Things To Be Found In Books

A. AAF Radio Data & Flight Information

1. Commercial Broadcasting Stations & Frequencies
2. CAA Flight Regulations
3. Volume of gas available at different fields

B. AAF Instrument Landing Procedures

C. AAF Radio Facilities List

II. AAF Instrument Approach AND LANDING CHARTS

1. Confidential
2. Includes all airports
3. More detailed than
a. Vertical X-chart
b. Ground stations
c. Clearances, etc.

III. Airport Information

A. AAF Installations Directory

1. All AAF fields
2. Revised each month
3. Runway length
4. " strength
5. Gas available
6. Maintenance available

B. CAA Directory of Airfields

CITY	AIRPORT	LONGITUDE	ALT	CLASS	CROSS	EQUIPMENT
ALBUQUERQUE	BOMBARDIER	6 W 40 N, R 23	261	55, 8, 5, 5	AUSTIN	T-39, KES, STW
		5000				No STW, T-39

APP
C. AIRPORT DIRECTORY of CAMBODIA U.S.
1. Very detailed.

D. WEEKLY NOTICES TO ARMBN

ADK Rules & Regulations

ADK Reg

30-15 (1st class)

30-23 (2nd class)

15-25 (3rd class)

More 35-2

For Official interpretation of rules see
Army Regulations write these channels to:

- { Commanding General ADK
- { Asst Chief of Staff, Training
- { Flight Operations Division, Washington D.C.

DEFINITIONS

CONTACT FLYING - Ground or water - within gliding distance & can be used for visual reference.

From clouds - 500' vert. 2000' horiz.

Visual Flying - any flight not contact.

Clearances

open territory 500'
populated " 1000' min. - climb to glide alt.
Controlled Area 3mi radius & 1500' high
Range approach 1mi wide range to field -

CFR { Controlled Zone 1000' & 3mi (1mi. at tower operator discretion)
Outside Control Zone 1000' & 1mi at night
" " 1000' & 2mi at night
" " over 1000' - 3mi day & night

IFR white Takeoff min. 500 + 1 D or N
Green 200 + 1/2 " + "

(Class) Landing Minimums 70 08-15-3 (not approach)
NIGHT 3 at given min.
White Cards only 500 + 1
(Green Cards con) 700 + 1/2
disc 0-0 600 + 2
500 + 3
Tower cannot deny you landing field is never closed.

ALTERNATE AIRPORTS

1. Field Suitable for type aircraft.
2. 45 min cruise fuel after arrival at alternate.
3. Weather must remain same or improve during flight.
- A. With Radio min at 2000 \oplus 3 mi.
1500 \oplus 3 mi.
5. No Radio min Ceiling unlimited + 3 mi.

MARGINAL WEATHER - applies to pilots with out inst.
Less than 2000' \oplus 3 mi.
" " 6 mi.

White card holder without 500 hrs can have the IFR clearance

Class of non-application (Book at 60-16 Par 49
Per. 49

- a. Danger - Make a report within 24 hours after landing of any violation to operations officer.
- b. Military Necessity
- c. C.O. can make more stringent any regulations.
- d. Training

Clearance Authority

1. C.O. of base.
2. Pilots Senior on CFR Command any time.
Green card holders.
3. Outside agency ~~and~~

and IFR if have white card.

ARMY FLIGHT SERVICE - operations office + clearing authority in air or by phone or telegram

FORM 23 - Flight Priority

CRA TRAFFIC CONTROL (ATC)

1. Primary Traffic Control Center

A. Components

1. Interphase Circuit

a. Designed to set initial descent range within control area

2. Teletype circuit connecting Control Center

B. Clearance

1. ATC Controls all en route traffic

2. Off course traffic not controlled and no one can tell you, may alter course

C. Clearances

1. CFR

Not specify alt. for night this (single)

a. Not necessary to specify altitude for day flight

b. Must fly in weather - some contact minimums

c. Any flight in weather below these must be cleared IFR.

d. All towers operate CFR

3 mi radius

1500 ft alt.

1 mi visibility

necessary

2. Clearance CFR authorized even when

destination is below 3 mi vis. because

of smoke or haze. Sequence shows N

for Instruments - however, Only additional operation necessary is for pilot to contact tower before entering control area.

2. IFR

a. Altitude specified for each IFR leg

1. Odd thousands E or N bound

even "

W or S "

2. Maintain 1000' above all terrain

b. 500' on top Daylight only

1. Permissible to dodge towering clouds

C. Visual Contact CTC/2000'

- a. below CFR minimums
- b. Pilot maintains contact with ground even tho below CFR minimums
- c. If he cannot maintain reference to ground he should ^{alter} alt. specified and goes on instr. alt.
- d. Ask for alt. alt. clearance at min. safe alt.
- e. only cleared for short flights from terminal pt to next safe alt.
- f. off airways flight approval given easily.

3. ROUTES

- a. Always fly route designated on clearance.
- b. Always give most accurate ETA possible
- c. Radio in revised ETA if conditions change a very much.

D. REPORTS

1. POSITION REPORTS

- a. Good policy CFR + required on IFR.
- b. Outline of Report: Flight Plan
 1. Identification Group (last 4 numbers) IFR
 2. Position: IFR reference to Range (exact position) CFR " " or as given by pilot
Note: IFR exact position means when crossing 1st, 2nd, 3rd sta, fix or some place that can be definitely spotted
NO ESTIMATES OF POSITION ON IFR
 3. Time: - time position was checked over fix - (minutes enough is 15 for 1034)
 4. Altitude & Weather:
ie. 5000 3000 on top
5000 between towers
 5. DESTINATION use name of city means municipal airport. Best to give NAME OF FIELD.
 6. ETA over next Radio Fix -

Not Required but recommended

ESTABLISHING CONTACT WITH RANGE

1. Normal Voice Procedure
2. Key 2 to Call letters on Tone (PWS 200 200 K)
3. Call nearby Tower or Field.

ARMY FLIGHT SERVICE

1. Clearing authority for pilots in route.
2. Provide additional weather advisory information.

AIR TRAFFIC CONTROL

1. Will approve and flight plan or flight request over the below prescribed minimums. It will advise of regulations but will clear any pilot as long as ~~no~~ other air traffic is out on that.

INST. APPROACH SEQUENCES

1. First come first serve except hospital ships always for priority.
2. Holding. Standard procedure is to hold for 4" on leg opposite leg that passes over field.
3. Range gives expected approach clearance time every time holding instructions.
 - a. In case of transmitter failure pilot can start his approach at that time.
 - b. 15 minutes is time allowed for inst. approach.
4. Pilot checks fuel when given holding clearance if not enough requests an earlier time.
 - a. An extra 100 lbs fuel is necessary at present times for holding alone (over and above at a 100 lbs)
 - b. Use max endurance power while holding.
5. Clearance to tower means you or #1 to approach don't turn to tower until inst. letdown has been performed and you break contact.

6. Pilot's Contacts Range at high low (or holding alt) and when he loses contact. Contact can be reported to TRD. tower.

b. Also often required to report procedure turn.

c. When holding only contact with tower necessary is when pilot arrives over range or holding fix.

d. When using Range Filter identify Range of that fact.

7. EMERGENCY IN CASE OF TRANSMITTER FAILURE BEFORE RECEIVING HOLDING INST.

a. If possible change to CFR.

b. If he can let down contact and place in route let down and land at nearest sta.

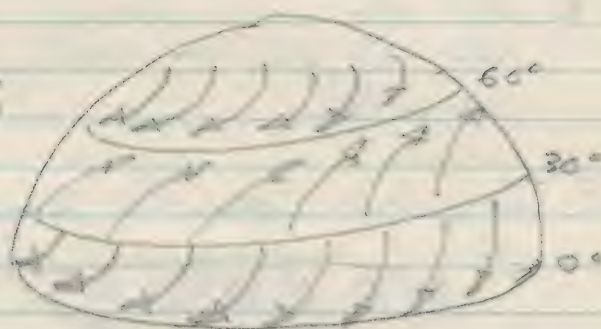
c. Let down at 500'/min to initial approach alt just before reaching sta. and make immediate approach.

WEATHER MAPS

Circulation



Coriolis Force
due to rotation of earth



AIR MASS SYMBOLS

1. Moisture Content

- a. wet mass m (maritime)
- b. dry mass C (continental)

2. Temperature

- a. Cold P (Polar)
- b. Warm T (Tropical)

3. Stability (relation of air mass to ground under it)

- a. unstable (air colder) K (cold)
- b. stable (air warmer) W (warm)

Fronts on Map

———— active front

- - - - - front aloft

oooooo front forming

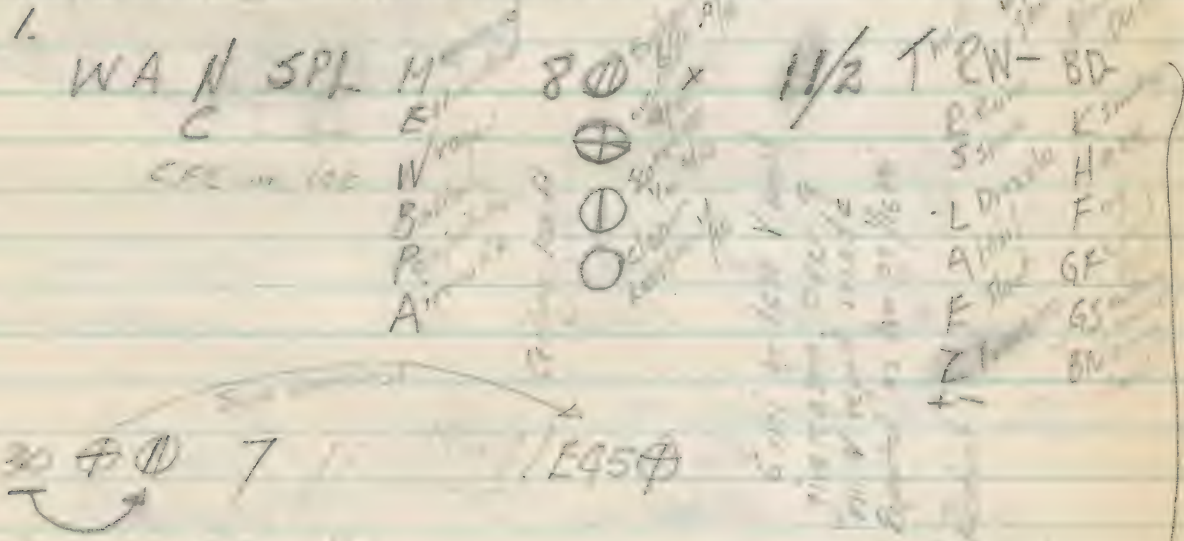
Handy Sequence

I. Circuits

A. 12 Circuits in Continental U.S. come in
 handle in 1/2 hour on teletype.

1. Circuit clip boards must list Sta, Cal letters, Flows
 listed in order they come in on sequence.
2. All circuits report on Boston Time.
3. First sta on sequence for a circuit type in
 circuit is for circuit it comes from. Kansas City thus
 368 290630R
 circuit date time
4. All sta on circuit report their monitoring
 sta in circuit relays other key stations in other
 area.

B. Sequence Interpretation



DBN F 30 7 1 E45

High on ...

00/53/47 + 15/773 - 4 NE

Comments

Station	Time	Remarks
WA	...	...
N	...	...
SPL	...	...
M	...	...
C	...	...
E	...	...
W	...	...
B	...	...
P	...	...
A	...	...

ARMY AIR FORCES
AIRCRAFT ARRIVAL REPORT

OPERATIONS OFFICE A
ADDRESS

DATE

PILOT'S NAME B	RANK	HOME STATION	ORGANIZATION	AIRCRAFT NUMBER
NAME, INITIALS, RANK, HOME STATION OF OTHER OCCUPANTS				

LIST ADDITIONAL PASSENGERS ON SEPARATE SHEET

C WEATHER DATA	EXISTING LOCAL	ALTIMETER SETTINGS
EXISTING ROUTE		LOCAL
		DESTINATION
DESTINATION (LATEST)	TIME	ALTERNATE
ALTERNATE (LATEST)	TIME	
FORECASTS	(ESTIMATED FLIGHT TIME PLUS 2 HOURS)	RESET ALTIMETER BEFORE APPROACH
ROUTE		
DESTINATION		
ALTERNATE		
WINDS ALOFT GIVE ALT. DIR. VEL. AS PILOT REQUESTS		
AAF FORM 23A REQUIRED <input type="checkbox"/> NOT REQUIRED <input type="checkbox"/> FORECASTER		
TIME		

D FLIGHT PLAN	(PILOT COMPLETES) RADIO CALLS	TYPE OF AIRCRAFT	PILOT (LAST NAME ONLY)	POINT OF DEPARTURE
1	2	3	4	
CFR	CFR	CFR	CFR	
ALT. _____	ALT. _____	ALT. _____	ALT. _____	
ROUTE _____	ROUTE _____	ROUTE _____	ROUTE _____	
IFR TO _____	IFR TO _____	IFR TO _____	IFR TO _____	
AIRPORT OF FIRST INTENDED LANDING		TRUE AIR SPEED	TRANSMITTING FREQUENCIES KC KC	RECEIVER ONLY KC KC
PROPOSED TAKE OFF TIME	EST. TIME ENROUTE	ALTERNATE AIRPORT	HOURS OF FUEL (CRUISING)	INSTRUMENT RATING TYPE NONE
REMARKS: SHOW FIXES WHICH WILL BE REPORTED WHILE ON INSTRUMENT FLIGHT.				
				PILOTS SIGNATURE
TOWER FREQUENCIES DESTINATION KC	ALTERNATE KC	WEATHER CODE RECEIVED <input type="checkbox"/> YES <input type="checkbox"/> NO	TO DESTINATION	MILEAGE DEST. TO ALTERNATE
			<input type="checkbox"/> COMMAND PILOT	<input type="checkbox"/> SENIOR PILOT
			<input type="checkbox"/> CONTRACT PILOT OF CARGO AIRCRAFT	<input type="checkbox"/> PILOT

E FLIGHT CLEARANCE AUTHORIZATION				
SUBMITTED TO	TIME	BY	OPERATIONS IDENTIFICATION NO.	
TIME APPROVAL RECEIVED	CONTROL INSTRUCTIONS RECEIVED		CLEARING AUTHORITY	
INSTRUCTIONS AND APPROVAL TRANSMITTED TO PILOT OR TOWER BY:		ACTUAL TAKE-OFF TIME	CLEARANCE OFFICER	

G ARRIVAL REPORT				
THIS COPY TO BE GIVEN TO PILOT. Pilot will complete "Arrival Report" and present to line crewman meeting the arriving aircraft, for his information. Line crewman will then forward to the operations office. Home station will be notified in the event of an overnight stop.				
DATE AND TIME OF ARRIVAL	R. O. N. <input type="checkbox"/> YES <input type="checkbox"/> NO	SERVICE REQUIRED <input type="checkbox"/> GAS <input type="checkbox"/> OIL	DESIRED DATE AND TIME OF DEPARTURE	DEPARTING FOR:
WHERE PILOT CAN BE REACHED AT THIS STATION		REMARKS:	LINE CREWMANS SIGNATURE	

$$\begin{array}{r}
 455 \\
 3+115 \\
 \hline
 95 \\
 55 \\
 01 \\
 \hline
 \times
 \end{array}$$

$$\begin{array}{r}
 455 \\
 15 \\
 \hline
 470
 \end{array}$$

11 40 2970
 2 7 788
 - 2989
 1 7 2782
 1 8 10 7946

8 40 10

$$\begin{array}{r}
 4 \times 3 = 12 \\
 2989 \\
 15 \\
 \hline
 2981
 \end{array}$$

$$\begin{array}{r}
 52 \\
 7600 \\
 1000
 \end{array}$$

$$\begin{array}{r}
 11 \\
 2989 \\
 2989
 \end{array}$$

USE OF SEQUENCES

1. check forecasts
2. Along with 4-X map to 1. - WX on to date
3. No - indicates

Radiation Fog (Ground Fog)

1. Width Temp Dewpoint spread - under 3°
2. cloud type - under spec 8
3. Clear sky - rapid cooling by radiation at ground

FRONTAL PASSAGE - Look For Change in =

1. Temp.
2. Dew Point.
3. Wind direction
4. Pressure (?)

FOREST'S ADVICE

ILCA written in plain English - early Eng. always available

Cercis canadensis Frax. reflex.

II ROUTE - 25 mi each side track

II AREA - Several 100 miles radius

Forecast - Weather forecasts every 6 hours for an 8 hour period

1. 7 CAA Regions 1. Naval
2. Ottawa

7 CAG Regions

1. New York
2. Boston
3. Chicago
4. Fort Worth
5. Kansas City
6. Omaha
7. Washington State

3. There is in any box station in the country.

3. Standard procedure in writing

Acas, Caba. + Terminal Island in front.

1. Temperature
2. Clouds & weather - precipitation
3. Turbulence
4. Visibility
5. Winds aloft
6. Further outlook & how present forecast.

Atmospheric Soundings

Probe - Carrying a thermometer, hygrometer, barometer
(Rohde & Schwarz Balluff) released about noon & midnight EDT
Rohde & Schwarz from all 65 stations in US.

Even 500 mb rain data from all 65 sta but plot data
from only about 15 sounding stations.

Sounding is representative of the air mass above sta
except for slight changes due to areas over which air mass
will be representative of that air mass as it moves
along.

Clouds - 85% or above is wet air hence clouds.
85% because of lag in moist.

Inversions wet to dry top at wet point

Surface - only inversions in lower 2-3000'

Subsidence (High Altitude)

Fronted

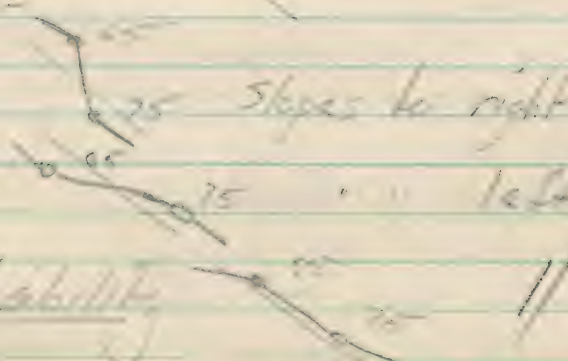
use this point for frontal
altitude
85 frontal inversions if drop in
humidity is less than 15
points in humidity
100

Turbulence

Stable

Unstable

Neutral Stability



VERTICAL CURS SECTIONS

1. Drawn up for frequently used routes out of a station 4 times a day from same info as used on weather maps & supplemented by adiabats.

Form 23A

1. Fill in at request by browser
 2. Fill in forecast
-

REVIEW

A. SUGGESTED PROCEDURES for getting true picture of weather at weather sta

1. Synoptic Charts
2. Forecasts
3. Hourly Sequences

B. SYNOPTIC MAPS.

1. Get general picture
a. Circulation
b. Pressure. Thunderstorms etc

C. FORECASTS

Will weather remain the same or get worse along route.

D. SEQUENCES

1. Trend of weather en route & at destination
 2. Visibility
 3. Clouds & Passages
-

VERTICAL X SECTIONS

1. Locate & draw in fronts

- a. locate front on ground
- b. determine slope - adiabats & synoptic map for same time
- c. move up to take off - hourly sequences
- d. check speed of frontal movement which will change slope.

2. In the level (freezing level) 0°C

and at different level in same air mass - adiabats
mark in to present time

- b. ~~Apparent~~ level in such case mass drop down
 after passing front
 3. — Turbulence in Clouds, Radiative chart

FRONTS & Front Processes Than They

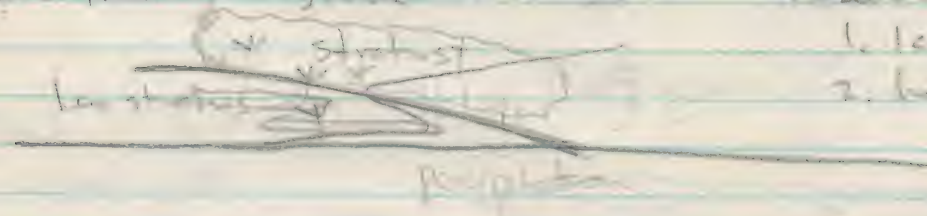
A. Weather in Fronts Depend upon.

1. Moisture Distribution Aloft
2. Stability — particularly in warm air mass
3. Lift action and speed of lifting.
 - a. slope of front
 - b. Speed of frontal movement
 - c. Direction & velocity of warm air mass.

B. Cold Fronts

Slow - 0-10 mph $\frac{1}{120}$ slope
 Fast 5-60 mph $\frac{1}{50}$ slope

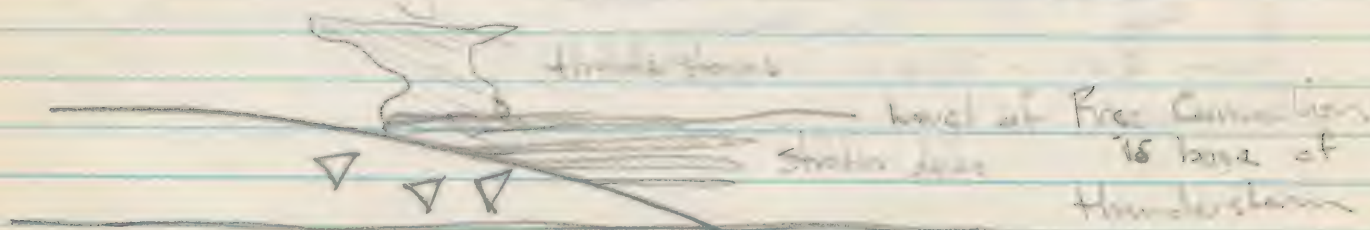
1. Slow moving stable warm air



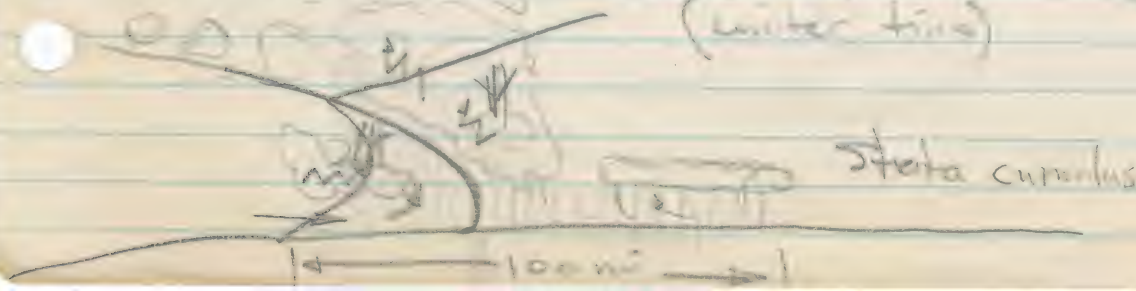
Hazards

1. fog
2. low ceiling & fog

2. Slow Moving unstable warm air mass



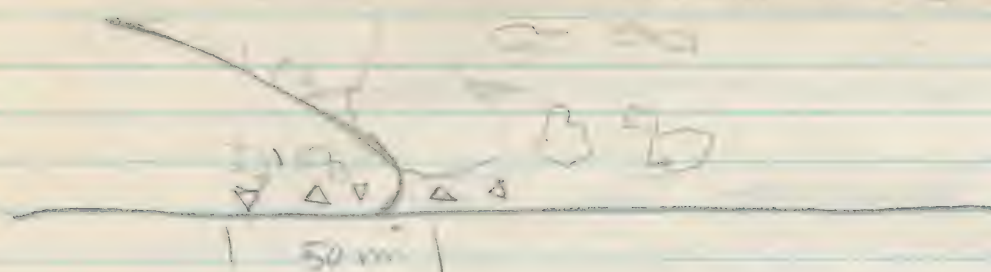
3. Fast Moving Stable warm air (winter time)



HAZARDS

1. Freezing Rain, Calm (ice)
2. Mild Turbulence
3. High winds aloft in cold air.

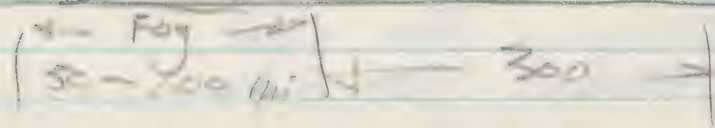
4. Fast moving cold front unstable weather
+ thunder storms



C. WARM FRONTS

1. Movement 0-5 mph
35-40 mph $\frac{1}{100}$ slope
 $\frac{1}{400}$ slope

2. Unstable weather
stratus clouds
stratus clouds
low stratus



Hazards

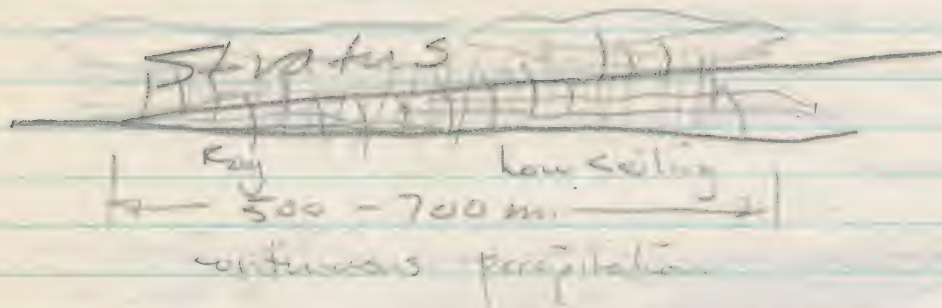
1. Landing weather very bad
2. Wide area of bad weather alt. hard to find

3. Icing.

Best to fly on top & edge Thunderstorms

3. Fast moving warm front

1. lower ceilings over very large areas



ICING

Structural

1. Rime
2. Clear
3. Combination, Rime & Clear
4. Frost
5. Carb.

Results on Aircraft

1. Deform wing
 - a. Increased stalling
2. Vibration
 - a. Prop ice
3. Added weight

To GET Ice - Must have freezing temp + visible water

(Combination)	Rime	-8°C	on down	small water droplets
	Rime & Clear	0°	" "	Small fangs " "
	Clear	0°C	to -8°C	large water droplets
	Frost	0°		no visible moisture on ground

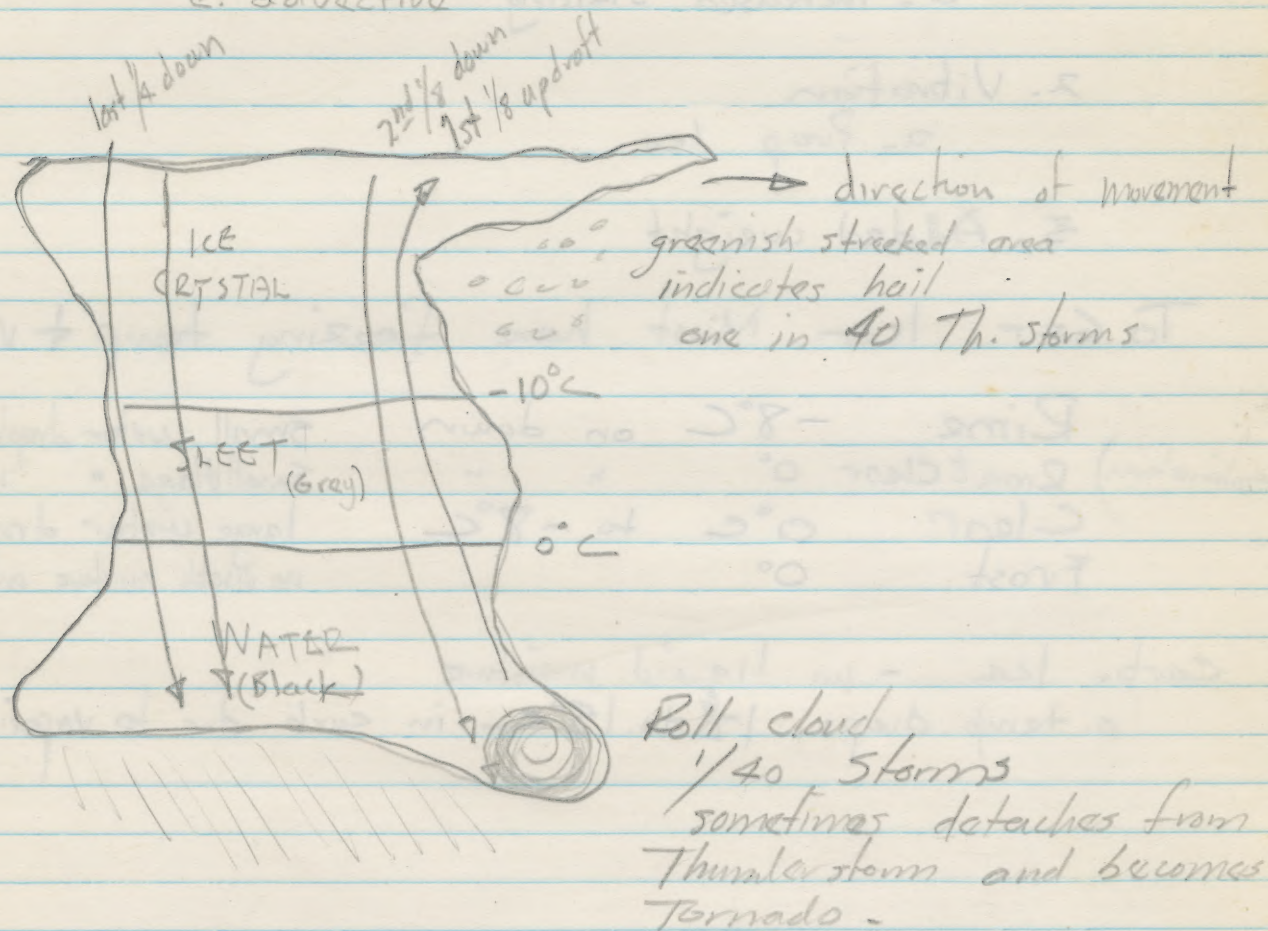
Carb. Ice - no liquid moisture

a. temp drops 12° to 15°C in carb due to vaporization of gas.

UNSTABLE PHENOMENA

THUNDERSTORMS

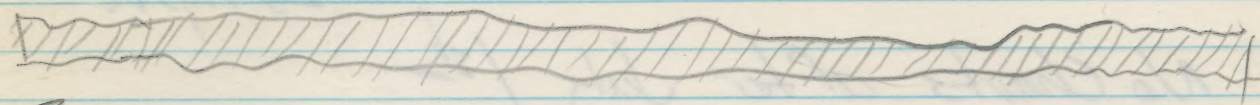
1. High moisture
2. Conditionally Unstable Air
3. Lifting Acting
 - a. Orographic
 - b. thermal
 - c. frontal
 - d. over running air
 - e. advective



HAZARDS

1. Best to go around or over then thru.
NOT UNDER.
2. Lightning - turn light on and keep head in cockpit.
3. Turbulence
 - a. Slow speed up to slowest controllable A/s
 - b. Hold O/s heading within approx 20°
 - c. Hold A/s within approx 20 mph
 - d. ~~Use throttle~~ Fly as straight as possible
 - e. Don't vary Attitude very much ~~use throttle~~ if necessary.

4. Best Altitude approx. 2000' above base to avoid roll cloud & stay below icing -
5. Hail - if you accidentally do get in fly straight,
6. HEAVY PRECIP. Increase power & lower wheels -

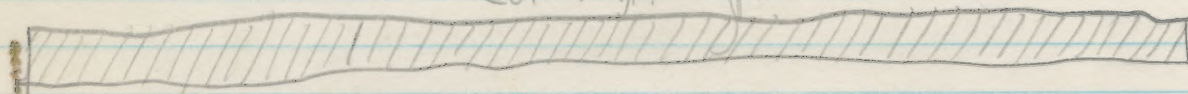


FOG

1. Have good alternate before clearing to destination likely to have fog -

TYPES

1. Ground
2. Advection
3. Evaporation: Fall of year along rivers & lakes
Cold front type



WINDS ALOFT

A. WINDS ALOFT CHARTS

1. SOURCE

- a. Visual - balloon
- b. Radio (1) Radar
(2) RDE - small transmitter on balloon
Called RAWIN in teletype code

B. REPORTS

Pilot Balloon

PB

Salt Lake

SL

Observations made at 0800Z, 1000Z, 1600Z, 2200Z

Direction 310°

Velocity 4 mph

03109

3206

62406

7000 8000 9000

02512

alt

5000'

320°

6 mph

alt

240°

6 mph

10000

220°

12 mph

MSL

6000 MSL

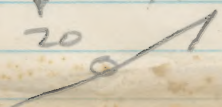
Reports come in every 1000' to 15000
every 5000 on up.

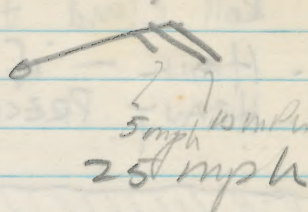
Winds aloft chart

If in red RAWIN

If in black Visual

20



Constant Level Chart 5,000 10,000 20,000
2 per day noon + mid night
gives wind direction + velocity + 
has isobars

No Charts after July 1st

Constant pressure charts will be used thereafter.